Oxford Cambridge and RSA

OCR-set Assignment

Sample Assessment Material

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering

Unit F134: Programmable electronics

Scenario Title: Roadworks traffic light system

Valid for assessment from September 20XX to 20XX.
For use by students beginning the qualification in September 20XX.

This is a sample OCR-set assignment which should only be used for practice**.**

This assignment **must not** be used for live assessment of students.

The live assignments will be available on our secure website, 'Teach Cambridge'.

The OCR administrative codes linked to this unit are:

- unit entry code F134
- certification code H127

The regulated qualification number linked to this unit is:

D/651/0637

Duration

About 20 hours of supervised time (GLH)
(work that **must** be completed under teacher supervised conditions)

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Information and instructions for Teachers

Using this assignment

This assignment provides a scenario and set of related tasks that reflect how programmable systems engineers would design, develop, assemble and test a programmable system to meet a given scenario and specification.

You can give this to students on or after 1 June 20XX to help them understand it before they start using it for assessment. The dates for which students can use it for assessment are shown on the front cover.

The assignment:

- Is written so that students have the opportunity to meet the requirements of all assessment criteria for the unit.
- Will tell students if their evidence must be in a specific format. If the task does not specify a format, students can choose the format to use.
- **Must** be completed under teacher supervision. Any unsupervised time allowed will be explained in the assessment guidance.
- We have estimated that this assignment will take about 20 hours of supervised time to complete.
  Students should need approximately:
  - 3 hours to complete Task 1
  - 5 hours to complete Task 2
  - 10 hours to complete Task 3
  - 2 hours to complete Task 4

You **must**:

- Use an OCR-set assignment for summative assessment of students.
- Familiarise yourself with the assessment criteria and assessment guidance for the tasks. These are given at the end of each student task. They are also with the unit content in **Section 5** of the Specification.
  Assessment guidance is only given where additional information is needed. There might not be assessment guidance for each criterion.
- Make sure students understand that the assessment criteria and assessment guidance tell them in detail what they need to do in each task.
- Read and understand **all** the rules and guidance in **Section 7** of the Specification **before** your students start the set assignments.
- Make sure that your students complete the tasks and that you assess the task fully in line with the rules and guidance in **Section 7** of the Specification.

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- Make students aware of all relevant health and safety considerations before starting any practical work.
- Make sure that students are appropriately supervised during any practical work and are working safely.

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- Intervene during practical work if necessary to ensure students' safety. In such instances, staff should assist the student to ensure their safety and so that they can continue with the subsequent assessment tasks, but they cannot be credited for the criteria directly addressing the practical skills where they have had to be helped unless the assessment guidance states otherwise.
- Give your students the Engineering **Student guide to NEA assignments before** they start the assignments.
- Complete the **Teacher Observation Record** for **Task 2**. You **must** follow the guidance given when completing it.

You **must not**:

- Use live OCR-set assignments for practice or formative assessment. This sample assessment material **can** be used for practice or formative assessment.
- Use this sample assessment material for live assessment of students.
- Allow group work for **any** task in this assignment.
- Change any part of the OCR-set assignments or assessment criteria.

Information for delivering tasks

Task	Requirements
Task 2	Access to appropriate virtual modelling and program simulation software is required.

Pages 1-4 are for teachers only. Please do **not** give **Pages 1-4** to your students.

You can give **any** or **all** of the pages **that follow** to your students.

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Tasks for students and assessment criteria

Unit F134: Programmable Electronics

Scenario Title: Roadwork traffic light system

Valid for assessment from September 20XX to 20XX.

For use by students beginning the qualification in September 20XX.

Scenario

You are a junior programmable electronics engineer working for the local council.

The council are to complete roadworks which will require a temporary traffic light system to be put in place to ensure the safe movement of vehicles through the roadworks.

The system will have 2 sets of traffic lights, one at each end of the roadworks. The road is reduced to a single lane while the roadworks take place, so the sets of traffic lights need to let traffic through at one end and stop it at the other.

An example of a traffic light system is shown below.

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Task 1

Investigating suitable microcontroller systems for the application

Topic Area 1 is assessed in this task.

You have been asked to investigate different microcontroller systems that could be used in a prototype roadwork traffic light system.

You should consider the most appropriate systems that are available for prototyping.

You will **not** need to use this microcontroller system for your prototype (Tasks 2 to 4) so you must not limit your investigation to what is available to use in your centre.

The task is:

To decide on a suitable microcontroller system for a prototype roadwork traffic light system.

Your evidence **must** include:

- A written report detailing your investigation and decisions.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P1: Analyse appropriate microcontroller types and casings for the application. (PO3)	**M1: Justify** the selection of a suitable microcontroller type, casing, system and programming language. (PO3)	**D1: Explain** how the selected microcontroller type, casing, system and programming language could be future proofed against new requirements. (PO2)
P2: Analyse appropriate microcontroller systems and programming languages for the application. (PO3)		

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Task 2
Design and assemble a prototype programmable microcontroller system

Topic Areas 2 and 3 are assessed in this task.

You have been asked to develop a prototype roadwork traffic light system that will control the sequence and timing of two traffic lights.

The prototype system must meet the **specification requirements given in Appendix A** and use a microcontroller system. Your design will need to consider what devices and components to use, any testing, simulation and/or modelling that will be used and safe working practices.

As this is a prototype system it does not require the use of actual traffic lights or vehicles.

You do **not** need to use the same microcontroller system selected in task 1.

The task is:

To design and assemble a **prototype** roadwork traffic light system using a microcontroller system that meets the specification requirements (Appendix A).

Your evidence **must** include:

- An outline program design and a hardware schematic/circuit diagram of the prototype system.
- A teacher observation record detailing the assembly methods used and adherence to safe working practices. This should be completed by your teacher and signed by you and your teacher.
- Annotated screenshots and/or photographs showing the model or simulations.
- Annotated photographs showing the safe assembly of the hardware for the system.
- Any other supporting written evidence.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P3: Select input and output devices and other components for a prototype microcontroller system that meet the specification requirements. (PO2)	**M2: Explain** how the devices and other components provide an appropriate user interface to meet the specification requirements. (PO2)	**D2: Justify** the selection of input devices, output devices and other components to meet the specification requirements. (PO3)

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P4: Produce an outline program design using a block diagram or flowchart for the prototype showing the main inputs, processes and outputs. (PO4)	**M3: Produce** a model or simulate element(s) of the microcontroller system in operation; making improvements and/or repairs as required. (PO4)	

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P5: Produce an appropriate hardware schematic/circuit diagram of the prototype system. (PO4)		
P6: Assemble the hardware devices safely for the prototype. (PO4)		
P7 Explain how the prototype will be tested to ensure the specification requirements are met. (PO2)		

Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
All	• The system to be assembled is a low voltage prototype that must meet the requirements of a given brief and specification. Only the input and output devices as listed in the unit content need to be used. For example, for a traffic light system a set of coloured LEDs should be used rather than a set of actual traffic lights. • Component data sheets and library codes may be used when completing the assessment. Access to appropriate virtual modelling and program simulation software is required.
P6	• Students must be able to perform the task safely to achieve this criterion. Staff must intervene if safe working practices are not being followed but where this happens the criteria cannot be awarded as achieved.
P7	• The test record sheet template provided can be used to show how the prototype will be tested, as well as for recording the results of testing.
M3	• The production of a model or simulation of element(s) of the microcontroller system in operation to experiment with and refine their solution. This is to trial/simulate code, along with the relevant circuit(s), for element(s) of, or a specific function from, a system.

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	• If no improvements are necessary (i.e. the program works as required first time) then this needs to be explained, with a justification as to why no improvements are required, otherwise any improvements made should be documented.

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Task 3

Programming and testing a programmable microcontroller system

Topic Areas 3 and 4 are assessed in this task.

Using the design documentation from Task 2, you can now program and test your prototype system.

The task is:

To produce, compile and download a suitable program and test the function of the fully assembled and programmed prototype microcontroller system against the specification requirements (Appendix A).

Your evidence **must** include:

- A screenshot or printout of the completed microcontroller program code.
- Annotated screenshots and/or an audio-visual recording showing any simulation completed.
- Annotated screenshots and/or an audio-visual recording showing the compilation and downloading of the program onto a microcontroller.
- A completed test record showing the tests completed, the outcome of the tests and whether any corrective actions were taken.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P8: Produce the program code for the prototype using constructs. (PO4)	**M4: Use** appropriate annotation of the program code to communicate how the program works. (PO2)	**D3: Produce** code which is well organised, efficient and correctly uses appropriate constructs. (PO4)
	M5: Simulate the hardware and program code in operation, correcting logical and syntax errors. (PO4)	
P9: Compile and download the program code onto a microcontroller. (PO2)		
P10: Complete visual inspection and functional testing of the prototype system in operation. (PO4)		**D4**: **Complete** integrated testing of the hardware and program code, repairing errors in the microcontroller system.

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		(PO4)

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Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
All	• Microcontroller programs must be written using an appropriate text-based language.
M4	• The purpose of the annotation is to demonstrate understanding of the key parts of the program code and constructs that have been used, and to allow a competent third party to amend/maintain the code.

Advice:

- You can use the Test Record Sheet template provided to record your test results.

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Task 4

Demonstrate the prototype microcontroller system in operation

Topic Areas 3 and 4 are assessed in this task.

You can now show your prototype microcontroller system in operation and judge its success against the specification requirements (Appendix A).

The task is:

To demonstrate your prototype microcontroller system in operation against the specification requirements.

Your evidence **must** include:

- An audio-visual recording of your prototype microcontroller system in operation with a voice-over and/or written notes.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
P11: Demonstrate how the operation of the prototype microcontroller system meets the **minimum requirements** of the specification. (PO4)	**M6: Demonstrate** how the operation of the prototype microcontroller system meets the **additional requirements** of the specification. (PO4)	**D5: Conclude** how well the microcontroller system in operation meets all the requirements of the specification. (PO3)

Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P11/M6	• The audio-visual recording only needs to be long enough to show the system working. The maximum recommended length of the audio-visual recording is 3-5 minutes.

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Appendix A

Specification requirements

As a minimum the prototype traffic light system **must**:

- Have two traffic lights; Set A and Set B, one at each end of the roadworks. Each set has individual lights coloured red, amber and green.
- In normal operation, cycle through the following 8 step sequence automatically and continuously:

Sequence step		1	2	3	4	5	6	7	8
Set A	Red	R	R	R	R	R	R		
	Amber						A		A
	Green							G	
Set B	Red	R	R			R	R	R	R
	Amber		A		A				
	Green			G					
Time (Seconds)		30	2	30	2	30	2	30	2

The lights have the following meaning in the sequence:
  - Red means that vehicles must not proceed through the roadworks
  - Red and amber means that the lights are changing, but the red light rule applies
  - Green means that the vehicles can move through the roadworks
  - Amber means that the lights are changing, and a vehicle should not proceed through the roadworks unless it cannot stop safely.

Additional requirements of the prototype roadwork traffic light system include:

- A user-friendly interface that allows the traffic light sequence to be stopped safely and the timing of the traffic lights changed, so that the lights return to ‘red’ as safely and quickly as possible. For example, the traffic light sequence may need to be stopped to allow a maintenance or emergency vehicle to pass safely through the roadworks as a priority.
- A method of resetting/restarting the prototype traffic light system safely.

As a prototype system it does not require the use of actual traffic lights or vehicles.

You do **not** need to use the same microcontroller system selected in task 1.

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Teacher Observation Record Form

Use this form to record what is observed.
Read the **guidance notes** below the form **before** you complete the form.

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering (Extended Certificate)

Unit number:	F134
Unit title:	Programmable Electronics
Task number:	2
Task title:	Design and assemble a programmable microcontroller system

Student's name:	
Date the activity was completed:	

What extra evidence is attached to the form?	

The **teacher** fills in this section:

What Assessment Criteria does this activity relate to?	
How does the activity meet the requirements of the Assessment Criteria? You **must** describe: 1. what the student did 2. how it relates to the relevant Assessment Criteria	
Teacher's name:	
Teacher's signature:	
Date:	

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The **student** fills in this section:

I agree with my teacher's description of how I completed this activity Yes ☐	
Use this space to make any extra comments.	
Student's signature:	
Date:	

Guidance notes

Both the teacher **and** the student are responsible for completing this form.

The **teacher must**:
- use the form to describe in detail what they observed the student doing.
- give contextualised details of what the student did and how this relates to the Assessment Criteria.
- say how well the activity was completed in relation to the Assessment Criteria with reasons.
- share what they have written with the student and offer the opportunity to discuss if the student disagrees with what is written.
- reach agreement with the student before the work is submitted for moderation.
- sign and date the form as evidence of agreement.

The **student must**:
- reach agreement with the teacher before the work is submitted for moderation.
- use the form to show that they agree with the teacher's record of the activity observed
- sign and date the form as evidence of agreement.

The form **must**:
- be accompanied by extra evidence, as required by the task.
- provide evidence that is individual to the student.

The form **must not**:
- contain a simple repeat of the Assessment Criteria.
- contain just a list of skills.
- be completed by anyone other than the teacher observing the activity and the student completing the activity.
- be written by the student for the teacher to sign.
- be used to evidence achievement of a whole unit or task in isolation.

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Template for Task 3

Test record sheet

Specification requirement	Test method(s) used	Results of testing

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NEA Command Words

The table below shows the command words that may be used in the NEA assignments and/or assessment criteria.

Command Word	Meaning
Adapt	• Change to make suitable for a new use or purpose
Analyse	• Separate or break down information into parts and identify their characteristics or elements • Explain the pros and cons of a topic or argument and make reasoned comments • Explain the impacts of actions using a logical chain of reasoning
Assess	• Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts
Calculate	• Get a numerical answer, showing how it has been worked out
Classify	• Arrange in categories according to shared qualities or characteristics
Compare	• Give an account of the similarities and differences between two or more items, situations or actions
Conclude	• Judge or decide something
Describe	• Give an account that includes all the relevant characteristics, qualities, or events
Discuss (how/whether/etc)	• Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement
Evaluate	• Make a reasoned qualitative judgement considering different factors and using available knowledge/experience
Examine	• To look at, inspect, or scrutinise carefully, or in detail
Explain	• Give reasons for and/or causes of something • Make something clear by describing and/or giving information
Interpret	• Translate information into recognisable form • Convey one's understanding to others, e.g. in a performance
Investigate	• Inquire into (a situation or problem)

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Justify	• Give valid reasons for offering an opinion or reaching a conclusion
Research	• Do detailed study in order to discover (new) information or reach a (new) understanding
Summarise	• Express the most important facts or ideas about something in a short and clear form

We might also use other command words but these will be:

- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

OCR would like to acknowledge the following: Page 5 *Traffic Lights at Road Works stock photo – Gannet77*/Gettyimages.com

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